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GEOLOGICAL AND STABILITY STUDY OF SYKIA CAVE (OLYMBI - CHIOS ISLAND)

By

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The Sykia cave has been formed in Jurassic limestones which belong to the alochthonous unit of Chios and it is located at the south part of the island. Generally, the limestones appear to be unbedded to thick-bedded at places, usually are of grey colour and of neritic phase, and overlay of a Palaezoic clastic formation of the same unit.

The cave consists of a large chamber (35m * 35m) which is connected with an elongated, low in height natural tunnel, in direction SW-NE. Both the cave and the tunnel have been developed along an old inactive fault, which runs along the centre line of the tunnel and forms the SE margin of the main chamber of the cave. The overall thickness of the cave's crust fluctuates between 5 to 30 metres.

This fault creates serious instability problems on the SE sidewall of the cave due to the resulted intense fragmentation which occurs. Evidences supporting that instability are both the observed fragmentation and the differential movements of the internal calcite ornament which covers all the sidewall surface of that part of the cave, as well as the large rock blocks which have been detached from the cave's roof.

At the place where the cave is located, four discontinuity systems appear to be predominant with their respective mean planes dipping with great angles. These discontinuities are mostly joints which are cemented by gouge material of calcareous or red calcareous-clayey origin. A fifth discontinuity system with small inclination angle, which is not quite obvious at least on the ground surface, appears inside the cave. This discontinuity system, which at many places coincides with the cave roof itself, is possible to represent the limestone bedding.

In now days, the cave under consideration is located some decades of meters above the level of the present karstic water table. Due to the small thickness of the limestones which form the crust (roof) of the cave the water inflow is highly limited, while for some time periods of the year it doesn't occur at all.

Laboratory tests which were carried out have shown that the intact limestone rock is very strong (the uniaxial unconfined compressive strength values are between 99 and 106 MN/m^2), while the shear strength values (or the cohesion c) of the cemented discontinuities are between 3,3 and 5 MN/m^2.

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The stability analysis of both the roof and the sidewalls of the cave for the rock block detachment or sliding of tetrahedral wedges either along the intersection lines of their planes or along the dip direction of these planes which form the tetrahedral wedges, resulted in high enough values for the factor of safety, taking into account the lower cohesion value of c=3,2 MN/m^2 which was determined for the gouge material of the cemented discontinuities. The stability analysis stated above, for negligible cohesion values or ignoring cohesion gave very low values for the factor of safety (F,1). On the other hand, the stability analysis of some rock blocks with various shapes and especially those like parallelepiped which were observed at some places on the roof of the cave, generated by the joints and the bedding plane, with three free sides, resulted in satisfactory values for the factor of safety even when very unfacourable conditions for the tightness of the joints themselves were considered.